

Dr. Blaxall's Report to the Local Government Board on an Epidemic of Diphtheria in the Rural Sanitary District of Sculcoates in the County of York, and upon the sanitary condition of the infected Localities.

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THE attention of the Local Government Board having been called to the mortality from diphtheria shown in the Registrar General's Returns for the 2nd quarter of the present year to have occurred in the registration sub-district of Ferriby, (population 1772), in the Rural Sanitary District of Sculcoates, adjacent to Hull, the Board addressed a letter to the Local Authority upon the subject, requesting to be informed as to the particulars of the outbreak, in reply to which they received a report from the Medical Officer of Health, dated 11th of August, wherein he stated that diphtheria had been present in the said sub-district since April, and had caused 15 deaths. In a subsequent report, dated 20th September, he stated that the disease had continued to prevail, and that the deaths then amounted to 22. In consequence of this large mortality, I was instructed to proceed to Sculcoates, and institute inquiry with a view to ascertain the probable cause of the outbreak, together with other particulars connected with the spread of disease.

Upon arrival at Hull I placed myself in communication with Mr. Chatham, clerk to the Rural Sanitary Authority, Mr. Walton, Medical Officer of Health, and Mr. Wellstead, Inspector of Nuisances.

The Medical Officer of Health informed me that, with the exception of two cases that occurred in a house at Welton Wold, the epidemic had been confined to the villages of Anlaby, Willerby, Kirkella, and Swanland. I therefore limited my inspection to these localities. In proceeding to give the result I propose to treat first of the circumstances and particulars of the epidemic, and secondly of the sanitary condition of the infected villages.

The villages of Anlaby, Willerby, Kirkella, and Swanland are situated to the westward of the town of Hull, and to the north of the river Humber. The site of the village of Anlaby is flat, being almost on a level with the Humber, from which it is about 2 miles distant. Willerby and Kirkella are situated on rising ground to the north of Anlaby, the former being about 2 miles and the latter 1½ miles distant from that village, while Swanland stands on the slope of a hill about three miles west of Anlaby. The character of the country generally is fertile and well wooded, and there are several good mansions studded about. The geological formation is chalk underlying beds of clay and sand of varying thicknesses. The population of the several villages was estimated by the Medical Officer of Health to the middle of 1876 as follows: Anlaby 523, Kirkella 317, Willerby 231, Swanland 473. Agriculture forms the chief occupation of the people.

The Epidemic of Diphtheria.

The epidemic of diphtheria which forms the subject of this report may properly be regarded as two distinct epidemics (having separate origin), the one confined primarily to the villages of Anlaby and Willerby, the other to Swanland. It will be seen hereafter that the disease was conveyed from the village of Anlaby to one house in Welton

Wold, and from Willerby to Kirkella. In all, I ascertained particulars of 63 cases and 26 deaths. The medical men informed me that the cases generally were characterised by ashy exudation of the throat. I had not myself the opportunity of seeing any cases in the acute stages, but several very distressing cases of diphtheritic paralysis came under observation, involving impaired vision, huskiness and thickness of voice, imperfect deglutition, and, occasionally, general paralysis, thereby leaving no doubt as to the nature of the disease. The cases arranged in chronological order according to the villages in which they occurred will be found in Tables 1, 2, 3, appended to this report.

As regards the Anlaby and Willerby Epidemic.—This epidemic dates its origin from four cases which occurred in children who attended the school at Kirkella. Of these four children three resided at Anlaby, and the fourth at Willerby, which stands two miles to the north of Anlaby. The 3 cases at Anlaby were in three distinct families, living in houses situated in different parts of the village, the dates of attack being respectively the 24th of April, the 3rd and 4th of May.

The first case proved fatal on the 29th of April.

The second case (May 3rd) calls for special detail as the nature of the disease in this instance was not recognised, but inasmuch as the sufferer was apparently the medium of diphtheritic infection to others, there is good ground for believing the attack to have been one of genuine diphtheria. The particulars of the case are as follows; the family, named Sanderson (residing at Anlaby), consisted of husband, wife, and seven children at home, and a daughter, aged 14, in service at Welton Wold (about 5 miles to the westward of Anlaby). The children went to school at Kirkella. One of them (a little girl) on returning home from school on the 3rd of May complained of sore throat, and the glands of her neck became swollen. She was not allowed to return to school, but the symptoms were so mild that no medical man was called in. On the 14th of May the daughter in service came to Anlaby for a couple of days on a visit to her family, being quite well herself at the time, as also was the family with whom she resided at Welton Wold, and no case of diphtheria being known to be present in that neighbourhood. On the 16th the girl returned to her situation, and on the 18th complained of sore throat: the next day Mr. Jackson was called in to see her, and on the 20th she was sent to her home in Anlaby when Dr. Locking saw her. Both these medical men recognised the case as typical diphtheria. Shortly after the girl's departure from Welton Wold the mistress' infant and subsequently the mistress herself were attacked, and both died, the cause of death being certified by the medical man who attended them to be "Diphtheria." Now the fact of the servant girl being attacked with diphtheria after spending a couple of days at her home in Anlaby (where her little sister at the time was suffering from sore throat and enlarged glands) and on her return to her situation herself communicating the disease to her mistress' infant, would seem to stamp the disease, in the case of the little girl first attacked, as diphtheria, and as such to be classed with the initiatory cases of this epidemic. Five other members of the Sanderson family suffered from sore throat, but, as in the case of the little girl first attacked, no medical man was consulted. I was therefore unable to ascertain the dates of their respective attacks.

The third case (4th of May) (case 3, Table 1) was of a severe type and was recognised by the medical man as diphtheria. These 3 cases were the forerunners of a succession of cases that occurred in this village, fresh cases continuing to appear every month up to the date of my inspection. In all, 13 houses were invaded, in which there were resulting in 25 attacks and 8 deaths.

The fourth case, already mentioned as having occurred on the 8th of May at Willerby, (case 1, Table 2) was that of a boy named Johnson. This was a severe case, diphtheritic paralysis supervening. But on the 18th of June the boy was considered sufficiently recovered to return to school; where the master, however, noticed that he looked very weak and ill. He continued to attend school with occasional intervals up to the 26th of June, shortly after which date he again manifested acute symptoms of diphtheria. It is noteworthy that up to this time no other case had appeared in Willerby, but the boy's return to school was followed by a succession of cases amongst the school children, including the boy's brother and some children in another family at Willerby, as well as the first cases which occurred at Kirkella.

As to the origin of the outbreak.—At the commencement of the epidemic the Medical Officer of Health, in his report to the Local Government Board, attributed the origin of the outbreak to introduction from other districts, but he subsequently attributed it to the

agency of impure water at Kirkella school. With regard to the first of these propositions, reference to the Registrar-General's Death Return for the last few years shows diphtheria to have been annually present in the Sculcoates Union, and in the adjoining Unions of Beverley and Hull, and to have increased in fatality, 2 deaths in the three unions being referred to it in the year 1871, 7 in 1872, 15 in 1873, 18 in 1874, and 28 in 1875. In 1876 the deaths decreased indeed to 12, but during the present year they have again increased, the diphtheria deaths during the last 9 months numbering 36, a fatality greatly in excess of any of the previous years. This tendency to increase is a matter of very grave importance, and should engage the serious consideration of the Authorities concerned. The distribution of the disease in respect of the three Unions is shown in the subjoined Table.

It may be mentioned that Hull is an urban district, Sculcoates and Beverley partly rural and partly urban. The increasing mortality above referred to occurred principally in the rural parts of the districts.

MORTALITY STATISTICS, abstracted from the REGISTRAR-GENERAL'S RETURNS, showing the Number of Deaths from Diphtheria obtained in the under-mentioned Unions during the Six Years and Nine Months 1871-1877.

UNION.	1871.	1872.	1873.	1874.	1875.	1876.	9 Months 1877.	TOTAL.
Sculcoates - - - -	1	4	6	8	6	2	27	54
Beverley - - - -	—	—	8	4	17	4	1	34
Hull - - - -	1	3	1	6	5	6	8	30
Total - - -	2	7	15	18	28	12	36	118

The annual presence of diphtheria as indicated by the above figures might, *primâ facie*, suggest connection of the present outbreak with pre-existing diphtheria, but the concurrent testimony of the medical men practising in the neighbourhood goes to prove that the last case of diphtheria known to have occurred in any of the villages under consideration, or in their vicinity, prior to the present outbreak, dates as far back as February 1876, when one case occurred at Willerby. They further informed me that there had been a marked absence of the allied diseases scarlatina, erysipelas, and croup; thus it would appear there is no evidence to establish connection with antecedent cases of diphtheria. At the same time, the possibility of such connection cannot be altogether excluded, seeing that the nature of the disease may often, through the mildness of the attack, escape detection, and in this way the disease may unwittingly be disseminated by the infected person, as exemplified in the case of the Sanderson family already referred to (page 2).

With regard to the second proposition, namely, the water at Kirkella school being the cause of origin. The somewhat simultaneous character of the outbreak would seem to point to the agency of some one cause operating upon the sufferers. Inquiry proved that there was no community of milk-supply nor of other articles of diet, and careful investigation of the sanitary conditions and circumstances of the infected villages and houses, with a view of ascertaining if there were any one cause common to the infected localities whereby the disease could have been propagated, failed to elicit any satisfactory clue to the solution of the problem. Attention, therefore, was next directed to the school at Kirkella, as apparently offering, in connexion with its water-supply, one condition common to the four sufferers. The school is attended by children from Anlaby, Willerby, Kirkella, and the adjoining neighbourhood; Anlaby being about $1\frac{1}{2}$ miles to the south, and Willerby $\frac{1}{2}$ a mile to the north of the village of Kirkella. Examination of the school register shows that during the period of the outbreak, that is from the 24th of April to the 8th of May, there were 142 children in attendance. The four children first infected continued to attend school, with occasional intervals, up to the dates of their respective attacks. The numbers contributed by each village are shown on the subjoined Table, side by side with the number attacked, and in comparison with the number of children who did not go to school, and amongst whom there was no attack.

VILLAGE.	Population under 15 Years of Age.	No. of Children in attendance at School.	No. of Children attacked with Diphtheria.	No. of Children who did not go to School.	No. of Attacks amongst the Children who did not go to School.
Anlaby - - -	175	42	3	133	Nil.
Willerby - - -	92	49	1.	43	„
Kirkella, and other Villages - -	Not known	51	Nil	Not known	„
Total - - -	267	142	4	176	—

It will be seen (1) that the attacks were confined to the children in attendance from Anlaby and Willerby, to the exclusion of the children from Kirkella and other villages; (2) of the 42 children who attended school from Anlaby, 3 were attacked, and of the 49 children from Willerby, 1 was attacked; (3) of the 133 remaining children at Anlaby, and the 49 at Willerby, who did *not* go to school, *not one* was attacked. The incidence of the attacks thus falling upon the schoolgoers from Anlaby, to the almost total exclusion of the other children (one case only occurring amongst them), may find some explanation in the circumstance that the Anlaby children living at a distance usually took their dinners to school, and thus would be likely to drink of the school water; whereas the other children going home to dinner would have less inducement to partake of it. Moreover, it is in evidence that the 3 Anlaby children attacked were in the habit of drinking the water direct from the tank, and had complained to their mothers of its being very bad. Two of the said children admitted to me having drunk of it about the time they were taken ill. In the case of the third child (deceased) the sister told me that the sufferer had been in the habit of drinking the water, and had done so shortly before she was taken ill. It is presumable, also, that the fourth child, viz., the boy who resided at Willerby, drank of it prior to his attack, for he told me that he drank of the water on his return to school, after his illness; though not before. But inasmuch as he admitted having drunk of it at one time, the probability is that he did so on other and previous occasions. On the other hand, it should be mentioned that the schoolmaster's family, consisting of himself, his wife, four young children, and a servant, who habitually drank of the water, all escaped. It is, however, noteworthy, as possibly affecting the question, that the water in their case was passed through a silica filter before it was allowed to be drunk.

The question may arise as to whether the first case (24th April) may not have been the source of infection to the three other cases that followed. (These cases, for convenience, we will designate A., B., C., D.) In answer to this it is in evidence that (1.) A. attended school for the last time on the 24th of April (the date of attack) from which date I am credibly informed that neither B., C., nor D. had any communication with A., nor did they go to the infected house.

(2.) B. was not at school on the 23rd or 24th of April (the last days of A.'s attendance), so probably, their houses being a distance apart, A. and B. did not come in contact with each other on those days. Allowing this, if B. did contract the disease from A. it was presumably prior to the 23rd of April. Now as B. first showed symptoms on the 3rd of May, this would give the exceptionally long period of at least 11 days incubation.

(3.) C. and D. were both at school on the 23rd and 24th of April, and were attacked respectively on the 4th and 8th of May, consequently if they contracted the disease from A. there would be a period of 11 days incubation in the case of C. and 14 days in the case of D. Thus the exceptionally long periods of incubation in the *three cases* would seem to negative the proposition that A. was the source of infection to B., C., D.

Having shown that the attacks were confined to children who presumably drank of the water at the Kirkella school, it seems necessary at this stage of the Report to consider the quality of the water with reference to its probable exposure to contamination. The supply consists of rain water collected from the roof of the school-house and stored in an underground tank. The tank at the time of the outbreak was described by the Medical Officer of Health as being situated at a distance of a few feet from the schoolmaster's house and about nine feet from a catch-pit, and 20 or 30 feet

from the school urinals and cess-pit privies, the land, moreover, sloping from these in direction of the tank, which was on a level with the surface. The tank was constructed of brick and partly cemented, the overflow being by means of an aperture about eight inches square in the cement. This opening communicated by a channel with the overflow drain of the catch-pit, which latter was uncemented and received drainage from the schoolmaster's house and the school urinals. It is obvious, therefore, that the tank was greatly exposed to the risk of pollution; and in view of this the Medical Officer of Health, in August last, when it should be stated the schools had been closed for about a fortnight or three weeks, collected samples of the water and submitted them for analysis to Mr. Baynes, the County Analyst. The result confirmed the suspicion entertained by the Medical Officer of Health as to the purity of the water, proving it to be highly contaminated (see copy of Analysis in Appendix). From the connexion established between the tank and the urinals by means of the catch-pit there is reason to suppose urine would have entered largely into the contamination, and it is to be regretted that the water was not analysed during the time the school was open, the probability being that the large number of children in attendance would have exercised a considerable influence upon the purity of the water.

To sum up. Upon consideration of the evidence adduced with reference specially to the attacks having been confined to children who presumably drank of the Kirkella school water, and the relation of the tank to sources of contamination, together with the certified impurity of the water on being subjected to analysis in August last, I am unable wholly to set aside the hypothesis that the water supply of Kirkella school might have been implicated in the causation of the outbreak, but the number of attacks was so inconsiderable as to render the evidence in support of this opinion very far from conclusive. My inquiries wholly failed to detect any source from which the water could have become specifically contaminated.

Swanland Epidemic.—The first case of diphtheria in this village occurred on the 11th May in a little girl named Stephenson, aged 13, who had come from Lincolnshire three months before on a visit to a family named Bayrim, consisting of husband, wife, and three young children, two of them at present at home, but the third absent in Lincolnshire. The Bayrim's house was one of five or six in a terrace. Stephenson was a delicate girl, but lived under precisely the same conditions as the Bayrim's and other occupants of the terrace, amongst whom were several young children. I was unable to connect the origin of this case with any local sanitary condition or circumstance. It has been shown that diphtheria was present at Anlaby and Willerby at this time, but I could trace no communication with the infected families beyond the circumstance that the father of the little girl Sanderson (one of the first cases at Anlaby) was employed with Mr. Bayrim in working a thrashing machine. It is asserted, however, that although he worked with Bayrim he was not inside his house after April. Thus, after most careful inquiry, I found no sufficient data to enable me to form any opinion as to the channel by which the disease was introduced.

The next case occurred on the 19th of June, and was followed by 24 others, extending by communication from the first case and from one another.

Having up to this point considered the two epidemics separately, the subject of the spread of the disease may be treated of conjointly.

Dissemination of Disease.

Diphtheria having once made its appearance in Anlaby, Willerby, and Swanland, inquiry into the history of the subsequent cases proves the spread of the disease to have been due to infection conveyed from the infected to the healthy by means of personal intercommunication. In this way the disease spread from house to house, and from Anlaby to Welton Wold, and from Willerby to Kirkella, resulting, as already stated, in a total of 63 cases and 26 deaths. Of these 63 cases 58 are traceable in a continuous chain to one or other of the five original cases. It is noteworthy that the infection would appear to have been disseminated by sufferers when in the incubative and acute stages of the disease, and also after a long period of convalescence. Another striking feature in connexion with the spread of disease was the peculiar inherent susceptibility to attack manifested in certain families, accompanied often by a corresponding readiness to yield to the effects of the disease. In illustration of this it

may be mentioned that in one family, consisting of nine members, six children were attacked and three died (Cases 3 to 8, Table 2). In another family, consisting of six members, five were attacked and two died (Cases 11 to 15, Table 3). In a third family, consisting of four members, all were attacked, the father, mother, and one child dying, and the other child remaining a victim to diphtheritic paralysis (Cases 23 to 26, Table 3). In the adjoining house there lived the father, mother, sister, and niece of the above (Case 25), the two latter were attacked (Cases 21 and 22), one case proving fatal and the other remaining afflicted with paralysis. This family susceptibility was perhaps more specially manifested in the case of three brothers, all married and living with their respective families in houses widely apart. Diphtheria invaded each of the three dwellings, attacking in the one house the husband and four children, one case proving fatal (Cases 4, 16, 19, 20, Table 3). In another house the husband and one child (mild cases), and in the third house two children, both cases fatal (Cases 2 and 3, Table 3). Upon inquiry into the history of these cases it was found that the three infected families had not been thrown more into personal contact with each other than with other families living in the neighbourhood who escaped. The schools commonly playing an important part in the spread of infectious disease through the bringing together of infected and healthy children, it should be stated in respect of the school at Kirkella that three cases are referable to this agency, and that these three cases proving fresh centres of infection, resulted in all in 10 cases and six deaths.

The general particulars of the several cases are included in the Chronological Tables appended to this Report; it may, therefore, suffice here to give examples of such of the cases as present peculiar features of interest.

Examples.—Case 1, Table 2 (Willerby).—Boy, named Johnson, date of attack, 8th of May. To recapitulate the particulars already given on page 2. This case was characterised by typical symptoms followed by diphtheritic paralysis, but on the 18th of June the boy was considered sufficiently recovered to return to school, when the master observed he looked very weak and ill. He continued to attend school, though somewhat irregularly, up to the 26th of June, when he ceased attendance altogether, and a few days afterwards again manifested acute symptoms of diphtheria. In connexion with this second attack, it must be borne in mind that the boy admitted having occasionally drunk of the school water after his return to school on the 18th of June. It therefore becomes an open question whether, through any peculiar susceptibility, this second illness was associated with the fact of his having drunk of the water. For my own part I attach little importance to the circumstance, thinking it probable the second illness was a relapse, due to the boy having gone back to school in a very debilitated condition, and observing further that, at this later period, there was no reason for connecting the school water with the existence of the disease. Up to this time there had been no other case of diphtheria in Willerby, but simultaneously with the boy's second illness (on or about the 30th of June) his brother was attacked, and died on the 20th of July (Case 2, Table 2). He attended Kirkella school 28th and 29th of June.

Case 3, Table 2.—Little girl, named Pluves, attacked 3rd of July, died on the 12th, attended school at Kirkella, notably on the 28th and 29th of June, and probably contracted the disease from walking there in company with the boy Johnson, in whom the disease was then in the incubative stage (see above, Case 2). Five other cases occurred in the Pluves family, two proving fatal (Cases 4 to 8, Table 2). One of the infected children continued to attend school up to the date of her attack, and thus it would seem was the means of introducing the disease into Kirkella (see following cases).

Cases 9 and 10, Table 2 (Kirkella).—Two little girls, named Mowforth and Batty, living in houses widely apart, both attacked on the 10th of July. One case (Mowforth) proving fatal on the 28th of July, the other (Batty) on the 2nd of September of diphtheritic paralysis. These children apparently contracted the disease from personal contact with the little girl Pluves (Case 4, Table 2), it being in evidence that one of the children sat next to Pluves at school on the 5th and 6th July, and the other walked to school in company with her. The sister of Pluves was at the time lying at home dangerously ill with diphtheria, and she herself was attacked on the 11th of July, so probably was in the incubative stage on the 6th of July when the little girls were in contact with her.

Case 11, Table 2.—Girl aged 4, attacked on 16th September, died on 28th of September, apparently contracted the disease from going on the 5th of September to see the dead body of little Batty (Case 10, Table 2), as there was no evidence of her having been exposed to infection in any other way, nor was there any other case of diphtheria present at that time in the village. Supposing the disease to have been thus

contracted on the 5th September, the unusually long period of 11 days incubation in this case is a noteworthy feature. A second case occurred in this house in a sister aged 18, date of attack about the 30th of September (Case 12, Table 2). In contradistinction to the case above quoted, in which a period of 11 days incubation was suggested, the following case may be given as illustrative of an unusually short interval between the exposure to infection and the manifestation of symptoms (Case 17, Table 1). Little girl, named Grace Brown, went on the 27th of July from her home in Hull on a visit to some friends at Anlaby; the next day she strayed from the house alone, and after a time was found playing at "Dawson's Walk" in company with infected children; on the following day she manifested symptoms of diphtheria, and died on the 2nd of August, the period of incubation in this case being about 24 hours.

Case 1, Table 3 (Swanland).—Girl Stephenson, aged 13, attacked on the 11th of May when on a visit to Mrs. Bayrim at Swanland, having come from Lincolnshire about three months before. The Bayrim family, as already stated, consisted of husband, wife, two children at home, and a little girl in Lincolnshire. Shortly after the girl Stephenson was attacked, Mr. Bayrim with his little boy left for Lincolnshire. During convalescence the girl Stephenson suffered from diphtheritic paralysis, vision and voice being much affected, but about the end of May or beginning of June she was considered sufficiently recovered to return to her home in Lincolnshire, and Mrs. Bayrim, with her baby, joined her husband, and other children, who were staying in the village adjoining Stephenson's home. Stephenson occasionally visited the Bayrim's up to the 19th of June, on which day they returned to their home at Swanland. On the way home the little boy complained of sore throat, and on the following day the medical man was called in to see him when he recognised the case to be one of diphtheria. The child died on 27th of June. There was no evidence of any case of diphtheria being present in the neighbourhood of Bayrim's house in Lincolnshire. Thus the source of infection in this case would seem to have been the girl Stephenson, in which case the disease was contracted either before the little boy left home for Lincolnshire,—and it lay latent in his system for three or four weeks,—or he caught the infection from the girl after her return to Lincolnshire, and about five weeks from the date of her attack. The little boy's sister (Case 3, Table 3) was next attacked on 27th June, and died on the 3rd of July.

Case 5, Table 3.—A girl (cousin of the Bayrim's), attacked on 29th of June, contracted the disease from visiting the Bayrim's.

Case 4, Table 3.—Another member of the Bayrim family, attacked on 29th June, did not visit at the infected house, but was in personal contact with little girl (Case 5) during the usual period of incubation.

Cases 11 to 15, and Cases 23 to 26, Table 3.—Nine cases in two families, four proved fatal. The sufferers were all down at one time and dependent upon neighbours for nursing, and in this way infection was spread to other families. These cases have been selected as affording sad examples of the want of hospital accommodation.

Age would appear to have exercised a considerable influence on the spread of the disease. Thus, of the 63 total attacks, 37, more than 58 per cent., fell on children between the ages of 3 and 12 years. This excess must be in part attributed to susceptibility peculiar to that particular period of life, and probably also to some extent to the greater exposure to infection of children at these ages attending school. This will be better understood by comparison of attacks in relation to population obtained at certain given periods of life. For this purpose, I subjoin statistics showing the distribution in respect of age of the 37 cases referred to in the united villages of Anlaby, Willerby, and Kirkella (Swanland is excluded from the calculation as I have not the requisite data as to population):—

Effects of
age upon
spread.

Ages 0 - 3 years.	Pop. 82	Attacks 4 (5 per cent.)
„ 3 - 12 „	„ 199	„ 23 (11 per cent.)
„ 12 - 15 „	„ 59	„ 4 (7 per cent.)
„ 15 years and upwards	„ 464	„ 6 (1 $\frac{1}{3}$ per cent.)

Here again marked susceptibility is shown in children between the ages of 3 and 12 years, to the extent of double that of infants, and eight times as much as persons aged 15 years and upwards.

As a short summary of the chief points of interest observed during this inquiry I would point,—

- (1.) To the impossibility of determining the exact cause of the Anlaby outbreak. This may probably in some measure be accounted for by the length of time which had elapsed before the inquiry.
- (2.) To the evidence that the spread of the disease was effected by personal inter-communication of the infected and healthy.
- (3.) To the multiplication of opportunities for infection resulting from the absence of proper means of isolation.
- (4.) To the period of incubation appearing to vary from 24 hours to 11 days, and to the evidence rendering it probable that persons during the incubative period infected others with whom they came in contact.

I was not able to trace any direct connexion between the spread of the disease and unwholesome sanitary conditions which I found to exist, and now proceed to describe.

Sanitary Conditions of the Villages attacked.

Though the sanitary conditions of the several villages present certain grave defects, on the whole they compare favourably with other rural districts I have inspected.

Dwellings.

The cottages as a rule are well built, having good sized windows and thorough ventilation, a few only exhibited signs of dampness.

Drainage.

The villages in question are provided with sewers and drains, consisting usually of glazed earthenware pipes, many of which have been laid down since 1873 at the suggestion of the Medical Officer of Health. The sewers and drains are void of systematic ventilation, the inlets of the drains affording the only means of escape for the sewer air. These are often untrapped, and where situated near the vicinity of dwellings, give rise to great nuisance. Aggravated instances of the kind came under observation at Anlaby near to the cottages occupied by Mr. Smith and Mr. Gibbons. In this village, also, the main sewer, after receiving the drainage of the churchyard, passes in near relation to one of the public wells, locally known as the "Big Well," and discharges, at a distance of about 25 yards from the said well, into a covered cesspit about 8 feet deep, where the solids precipitate and the effluent sewage is conveyed by glazed pipes to an open ditch by the side of the main road leading to Hull. The risk of contamination of the water in this well is increased from the circumstance that the portion of the sewer in nearest proximity to the well is constructed of porous butt-ended pipes. Throughout the district no attempt is made to dispose of the sewage in a wholesome manner. On the contrary, whether from villages or mansions, it is alike conveyed to open ditches, and there left to soak into the soil, evaporate, or ultimately find its way into the Humber. Occasional localities are found to be unprovided with drainage, as for example the cottages in Ringroses Lane, Anlaby. Here an offensive open ditch, in its course through one of the cottage gardens, passes in unwholesome relation to the dwelling. Altogether, the drainage of these villages must be regarded as very imperfect and defective. I am given to understand that a scheme for the improved drainage of the villages, including the conveyance of the sewage to the Humber, has been submitted to the Sanitary Authority by the Inspector of Nuisances.

Excrement disposal.

This is commonly effected by means of privies with small receptacles immediately under the seat, but in a few instances the discharge is into large and sometimes open cesspits. No provision in either case being made against soil saturation. Occasional examples of aggravated excremental nuisances were met with, as for instance at Kirkella, where a pigstye and privy drained into the same cesspit. Also at Swanland, where liquid discharge from a privy might be seen escaping within a few feet of the cottages, and again at Anlaby where two privies are built against the wall of a house, the wall entering into the construction of the receptacle. The country mansions generally are provided with waterclosets situated indoors; these drain into covered cesspits, which likewise receive the contents of the house drains. I am told the drains and cesspits are usually unventilated, thereby increasing the risk of sewer air being introduced into the dwellings through the medium of the waterclosets. The substitution of earth closets, together with Field's intermittent tank for the disposal of sewage, offers a practical and inexpensive remedy for these evils, while the relative situation of the houses and grounds would seem to render such suggestion easy of adoption. One or two gentlemen, however, to whom I mentioned the subject, objected, on the

plea that their servants would never attend to the closets. Meanwhile the serious danger to health involved in the present defective arrangements cannot be too strongly insisted upon.

The inhabitants of the villages under consideration derive their water supply from wells sunk in the chalk, and from rain-water tanks. Here it may be mentioned that the populous town of Hull is supplied with water pumped from a deep well sunk at Springhead, about a mile to the eastward of Anlaby. Prior to the sinking of this well, the subsoil and underlying chalk was filled with water, insomuch that the wells in use at Anlaby were only a few feet below the surface, but the pumping for Hull so lowered the water-level of the surrounding chalk that it was found necessary in the case of the wells generally to bore to the depth of from 80 to 100 feet. With regard to the purity of the water, there seems ground for suspecting contamination in respect of the "Big Well" at Anlaby, herein-before referred to (page 8) as being situated in dangerous relation to a defective sewer and a deep cesspit. The water of this well is said at times to stink, and it is held in such bad repute that the people, rather than have recourse to it, go to a well further removed from their dwellings for all the water they require for drinking purposes. Shortly before my visit the water of certain wells at Anlaby, Willerby, and Kirkella, including the "Big Well" at Anlaby, had been subjected to analysis by Mr. Baynes, the County Analyst, and pronounced by him to be wholesome. And at the time of my inspection the water from the "Big Well" was free from smell, but the fact of its varying in this respect is sufficient to justify suspicion as to its continued purity. At Willerby one of the wells is situated in unwholesome relation to a ditch which receives sewage. I received no complaint of the water, but it is obvious that the position of the well with regard to the ditch renders it liable to pollution. At Swanland many of the inhabitants use rain-water, there being only one well in the village, situated near a pond at the top of the hill, and at an inconvenient distance from several of the houses. The well is very deep, and the water is raised by means of buckets which it takes a man several minutes to wind to the surface. The rain-water tanks are usually underground, and are constructed of brick and cemented. Some are in an imperfect condition, admitting percolation; while the cleansing of them is a matter altogether neglected. Thus, I was told of one tank which had not been cleaned out for four years until last summer, when it was found to contain about half a foot of black mud. The school tank at Kirkella has already been the subject of special mention on page 4, in connexion with the outbreak of diphtheria. It is satisfactory to be enabled to state that recently this tank has been raised above the level of the surface and cemented throughout. The communication with the catch-pit has been done away with, the privy-pits abolished, and galvanised pails substituted.

Pigsties and accumulations of refuse are occasionally met with in unwholesome relation to the dwellings, but on the whole these villages may be considered more than commonly exempt from such nuisances.

Piggeries
and surface
nuisances.

The authority has no means at its disposal for the isolation of persons suffering from dangerous infectious disease, or for the efficient disinfecting of clothing, bedding, &c., and during the recent epidemic in no instance were the provisions of the Public Health Act, 1875, enforced with reference to the exposure of infected persons and things. The Medical Officer of Health was unfortunately through illness incapacitated from duty during part of the time of the epidemic, but upon his recovery he superintended the disinfection of infected houses and caused bills to be printed advising people against communicating with the infected. He also caused the schools at Kirkella and Swanland to be closed on the 23rd of July. Hitherto he has not been furnished with immediate information on the registration of a death from infectious disease, and the Registrar's returns of mortality have been sent to him fortnightly instead of weekly as requested by the Board's circular letter dated 23rd of March 1874. The Inspector of Nuisances was appointed about six months ago, but he has received no instructions as to the duties he is expected to perform. He has made no record of the places visited, nor other duties performed, save in so far as occasional entries in a pocket note-book may be considered to answer the purpose. The Medical Officer of Health and the Inspector of Nuisances are not under the Order of the Local Government Board.

Having completed my inquiry, I conferred with the Clerk to Sanitary Authority and the Medical Officer of Health as to the measures to be adopted to prevent the spread of disease. To this end I advised the providing of means for the isolation of the sick and the efficient disinfection of clothing, bedding, &c.; also the enforcing of the

provisions of the Public Health Act, 1875, with reference to the exposure of infected persons and things, and lastly that arrangements should be made to ensure the Medical Officer of Health receiving immediate information on the appearance of any fresh case of diphtheria or the occurrence of any death from infectious disease.

In concluding this Report, I desire to acknowledge the courteous assistance and valuable information afforded me by the medical men generally, and my thanks are specially due to Mr. Walton, Medical Officer of Health.

F. H. BLAXALL.

Local Government Board,
November 1877.

RECOMMENDATIONS.

- (1.) The villages should be provided with proper sewers and house drains (Public Health Act, 1875, sections 15 and 23). All sewers and drains should be efficiently ventilated. Provision should be made for the disposal of the sewage in such a manner as not to be productive of nuisance, and to prevent the fouling of water courses and ditches. Before proceeding to carry out this recommendation it is desirable the Authority should consult a skilled engineer upon the subject of the sewerage.
 - (2.) The excrement removal and disposal should be effected in accordance with the principles of the "Report to the Local Government Board on certain means of preventing excrement nuisance in towns and villages," care being taken that every house be provided with suitable privy accommodation, and strict supervision being exercised to ensure closets or privies being kept in a wholesome condition. (Public Health Act, 1875, sections 36-40.)
 - (3.) Water supplies should be protected from pollution. No imperfect drain or other contaminating circumstances should be permitted in the vicinity of the wells or other sources of water. Rain water tanks intended for storage of water for domestic use should be properly constructed and impervious, they should be ventilated, the water should be filtered, and strict supervision should be maintained to ensure the tanks being kept in a clean and wholesome condition.
 - (4.) Accumulations of refuse in the vicinity of dwellings should not be allowed. Pigs or other animals should not be permitted to be kept in situations where they produce nuisances injurious to health.
 - (5.) The Authority should provide a place for use as a hospital for the reception of cases of dangerous infectious disease (Public Health Act, 1875, section 131). On this subject the Authority may usefully consult the Official Memorandum "On Hospital Accommodation to be provided by Local Authorities." A disinfecting chamber (section 122) and a mortuary (section 141) should be provided. Sections 120 and 121, relating to the disinfecting of dwellings and things, as also sections 126 to 129 inclusive, relating to the exposure of infected persons and things, and the letting of infected dwellings, should be enforced.
 - (6.) The Inspector of Nuisances should be definitely instructed as to the nature of the duties appertaining to his office, and should be required to keep a report book; also a book showing a continuous record of the sanitary condition of premises in respect of which sanitary action has been taken.
 - (7.) The Sanitary Authority should make such arrangements as would ensure the Medical Officer of Health receiving from the Poor Law Medical Officers immediate information on the appearance of any dangerous infectious disease, and likewise from the Registrars returns of death, as recommended by the Local Government Board in their circular letter dated 23rd March 1874.
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APPENDIX.

COPY of ANALYSIS of the Water of the SCHOOL TANK at KIRKELLA, made by Mr. BAYNES, County Analyst, 16th August 1877, and abstracted from the Report of the Medical Officer of Health to the Local Government Board, dated 20th September 1877.

“ Total solid residue - - 6·1 grains per gallon.”
 “ Chlorine - - - - - 25 ” ” ”
 “ Free ammonia - - - - - 666 parts per million.”
 “ Albuminoid ammonia - - - 300 ” ” ”

TABLE 1.

LIST of CASES of DIPHTHERIA in the Village of ANLABY (Pop. 523), from the 24th April to the 28th September 1877.

No. of Case.	House.	Sex.	Age.	Probable date of Attack.	Result.	Remarks, including Probable Source of Infection.
1	House A -	Female -	7	24th April -	Died 29th April -	One of the 4 original Cases. Ditto. Ditto. Sister of Case 2. Five other cases followed in this family, but being mild attacks no medical man was consulted. (Cases 5-9.)
2	House B -	” -	Child	3rd May -	Recovered -	
3	House C -	” -	8	4th ” -	” -	
4	House B -	” -	14	18th ” -	Recovered (severe case).	
5 to 9	”	—	—	Dates not known.	Recovered -	No admission of personal contact with infected families, but as the sufferer lived within a short distance of infected houses, it is probable she came into contact with one or other of the above cases.
10	House D -	Female -	2 yrs. 8 mths.	23rd May -	” -	
11	House E -	” -	10 months	Early in June	Died 9th June -	Mother and child lived at Welton Wold. Probable source of infection the servant girl (Case 4) who contracted the disease from going to her infected home at AnlabY on the 14th May, and on her return to Welton Wold communicated the infection to the infant of her mistress.
12	”	” -	Adult	”	Died 11th June -	
13	House F -	” -	5	26th June -	Recovered -	Lived next door but one to House B and free intercommunication took place between the two families. Two other cases followed in this house. (Cases 14-15.)
14	”	” -	—	Not known	” -	Admitted by the mother to have played with infected children from House F.
15	”	Male -	3	12th ” -	Died 28th July -	
16	House G -	Female -	5	29th ” -	Died 2nd August -	Played in company with infected children from Houses B and F.
17	House H -	” -	5	12th Aug. -	Recovered -	House in the same terrace as Houses B and F. Free intercommunication between the families.
18	House I -	Male -	8	13th ” -	” -	The mother said it was probable the child had been in contact with one or other of the infected children in the neighbourhood.
19	House K -	” -	5	20th ” -	Died 31st August	Sister to Case 18.
20	House J -	Female -	1 yr. 8 mths.	30th ” -	Recovered -	Brother to the above.
21	”	Male -	6	15th Sept. -	Died 19th Sept. -	No direct evidence of personal contact with infected persons, but every probability that such did take place, as there were 7 or 8 infected families in the neighbourhood.
22	House L -	” -	3½ years	23rd ” -	Recovered -	
23	House F -	” -	Adult	29th ” -	” -	Father to Cases 13-15 (House F).
24	House M -	Female -	Adult	29th ” -	” -	Nursed Case 22.
25	House N -	Male -	7	29th ” -	Died 4th Oct. -	Remarks with reference to Case 22 are equally applicable to this case.

TABLE 2.

LIST of CASES of DIPHTHERIA in the Villages of WILLERBY (Pop. 231) and KIRKELLA (Pop. 317), from the 8th of May to the 30th September 1877.

No. of Case.	House.	Sex.	Age.	Probable date of Attack.	Result.	Remarks, including Probable Source of Infection.
1	House A - (Willerby).	Male -	10	8th May -	Recovered -	One of the original cases.
2	" -	" -	12	30th June -	Died 20th July -	Brother of the above (Case 1).
3	House B -	Female -	6	3rd July -	Died 12th July -	Supposed to have contracted the disease from walking to school on the 28th and 29th June in company with the above Case 2. Five other cases occurred in this family. (Cases 4-8.)
4	" -	" -	10	11th " -	Died 30th -	_____
5	" -	Male -	5	14th " -	Died 25th -	_____
6	" -	Female -	12	6th Aug. -	Recovered -	_____
7	" -	" -	3	8th " -	" -	_____
8	" -	Male -	1	19th " -	" -	_____
KIRKELLA.						
9	House C -	Female -	5	10th July -	Died 28th July -	This, and the following case, were probably contracted on the 6th July from personal contact with Case 4 (House B) at the Kirkella school. Case 4 being at the time in the incubative stage.
10	House D -	" -	8	" -	Died 2nd September of <i>Diphtheritic Paralysis</i> .	
11	House E -	" -	4	16th Sept. -	Died 28th Sept. -	Presumably contracted the disease from going on the 5th September to see the dead body of Case 10.
12	" -	" -	18	30th " -	Still ill -	Sister of Case 11.

TABLE 3.

LIST of CASES of DIPHTHERIA in the Village of SWANLAND (Pop. 473), from 11th May to the 10th September 1877.

No. of Case.	House.	Sex.	Age.	Probable Date of Attack.	Result.	Remarks, including probable Source of Infection.
1	House A -	Female -	13	11th May -	Recovered -	Origin of this case could not be traced.
2	" -	Male -	4	19th June -	Died 27th June -	Had been in personal contact with the above (Case 1), and it is presumed in this way contracted the disease.
3	" -	Female -	2	27th " -	Died 3rd July -	Sister of the above (Case 2).
4	House B -	" -	12	28th " -	Recovered -	Contracted the disease from personal communication with Case 5 when the latter was in the incubative stage.
5	House C -	" -	9	29th " -	" -	Frequented House A during the illness of Cases 2 and 3.
6	House D -	Male -	8	2nd July -	" -	Resided next door but one to House A.
7	House C -	" -	Adult	8th " -	" -	Father of Case 5 (mild attack).
8	House E -	Female -	11	10th " -	Died 19th July -	Was present at the funeral of Case 3. Probably was then exposed to infection; but there was no direct evidence to this effect.
9	House F -	Male -	1 yr. 11 mths.	25th " -	Died 29th July -	All communication with infected families denied; but it may be noted that Cases 4-7 were convalescing, and Case 10 in the incubative stage, with any one of whom there might have been personal contact.
10	House E -	" -	8	" " -	Recovered -	Brother of Case 8.
11	House G -	" -	7	29th " -	Died 5th August -	Lived within a few doors of House E. Highly probable personal communication took place between the two families. Further, this boy was taken ill at the Sunday school, where Case 7 was his teacher. Four other cases followed in this family, viz., a sister, both parents, and a brother (Cases 12-15).
12	" -	Female -	5	5th Aug. -	Died 17th August -	_____
13	" -	" -	Adult	6th " -	Recovered -	_____
14	" -	Male -	Adult	8th " -	" -	_____
15	" -	" -	10	9th " -	" -	_____
16	House B -	" -	12	11th " -	Died 26th August -	Brother of Case 4 (House B).

List of Cases of Diphtheria in the Village of Swanland—*continued*.

No. of Case.	House.	Sex.	Age.	Probable date of Attack.	Result.	Remarks, including Probable Source of Infection.
17	House H -	Female -	6	12th Aug. -	Recovered -	Resided next door to Cases 8 and 10, and admitted having visited at the infected house.
18	House I -	Male -	10	14th „ -	„ -	Lived within a few doors of three infected houses (E, G, H), to one of which the child's mother went daily to assist in nursing the sick, and it is highly probable he went in and out of the infected house.
19	House B -	„ -	Adult	„ „ -	„ -	Father of Cases 4 and 16.
20	„ -	„ -	9	18th „ -	„ -	Son of the above (Case 19).
21	House K -	Female -	4	24th „ -	Died 4th September	Lived next door to House G, and probably frequented the house, as the child's grandmother nursed the sick family.
22	„ -	„ -	18	29th „ -	Recovered, but afflicted with Diphtheritic Paralysis.	Aunt to the above (Case 21).
23	House L -	„ -	4	1st Sept. -	Recovered (afflicted with Diphtheritic Paralysis).	Niece of Case 22, and lived next door. Three other cases followed in this house, viz., the father, mother, and a brother (Cases 24-26).
24	„ -	Male -	Adult	6th „ -	Died 10th September.	_____
25	„ -	Female -	„ -	9th „ -	Died 18th September.	_____
26	„ -	Male -	10	10th „ -	Died 24th September.	_____

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